Single Top b-tagging and Jet Resolution Studies

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B-Tagging Studies

Sample

- 65000 events from rome.004530.recov10.wt_ph_ml.* and rome.004531.recov10.wt_pl_mh.*

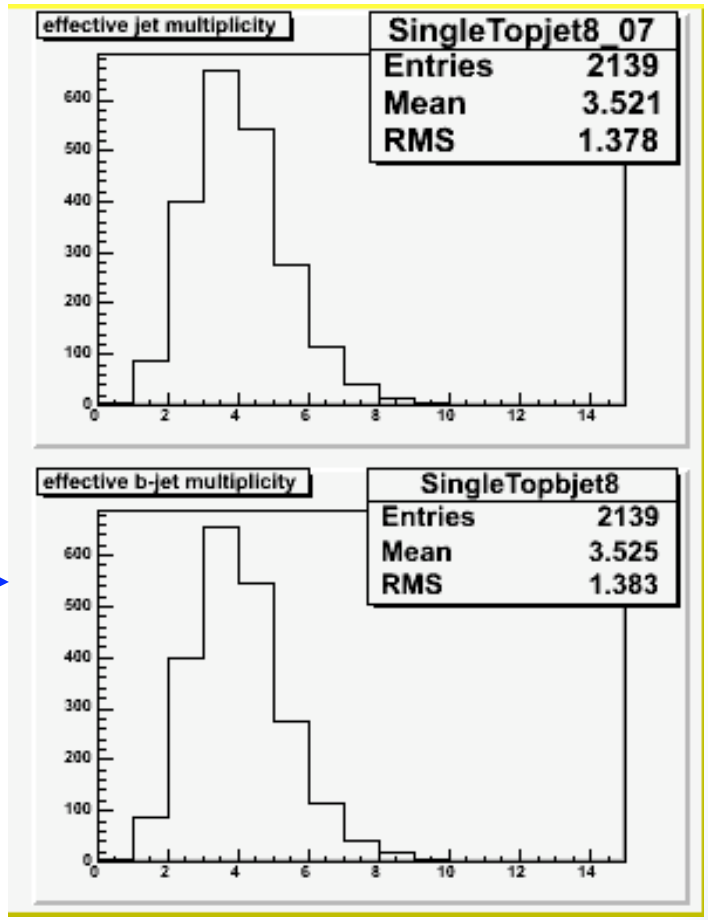
- Objects accessed:
  - ConeTowerParticleJets (Cone 07)
  - BJetCollection
    (btagging was run only for cone 0.7 jets)

Tests

- Preliminary look at b-tagging efficiency and light jet rejection
- Using as reference the talks of:
  - L. Vacavant, Rome Workshop
  - J.B. deVivie, May 2005 b-tagging group
- In Rome preliminary results, LHSig was used to select b-jets

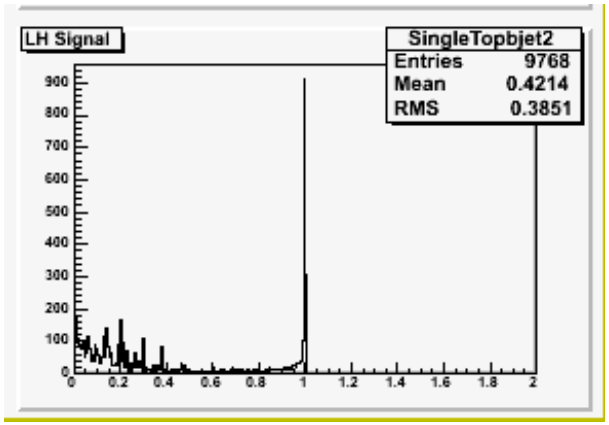
On BTagCollection

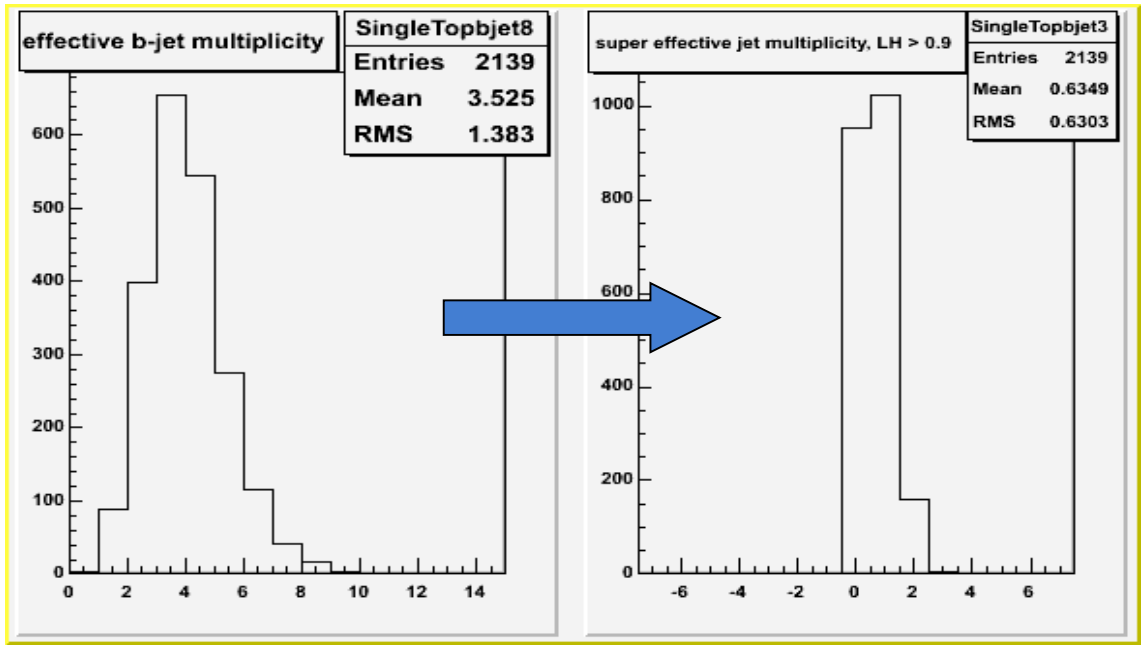
Btag collection, in Rome samples,
includes only cone07 Jets,
tagged or untagged
(same multiplicity as the
ConeTowerCollection)



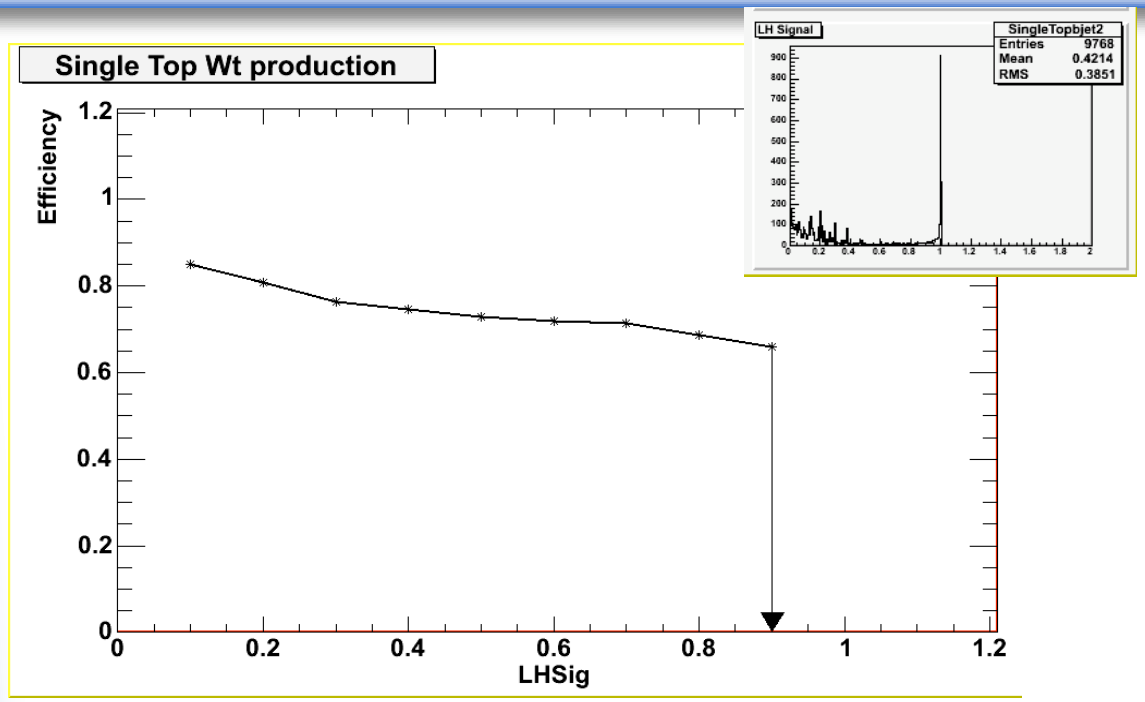
Rome selection

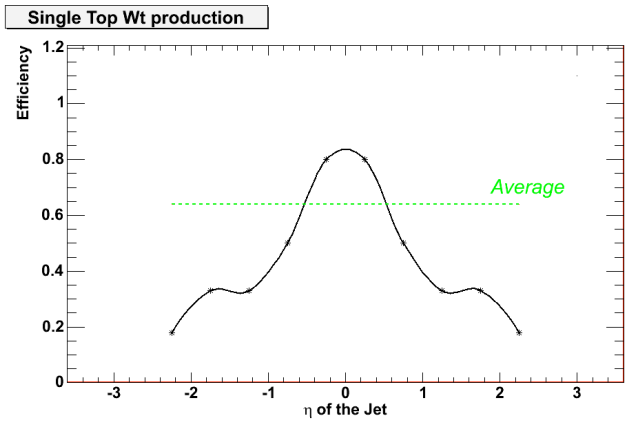
- In the BTagCollection a jet was selected if:
  - $E_T > 50$ GeV, $\eta < 2.5$
  - LHSig > 0.9

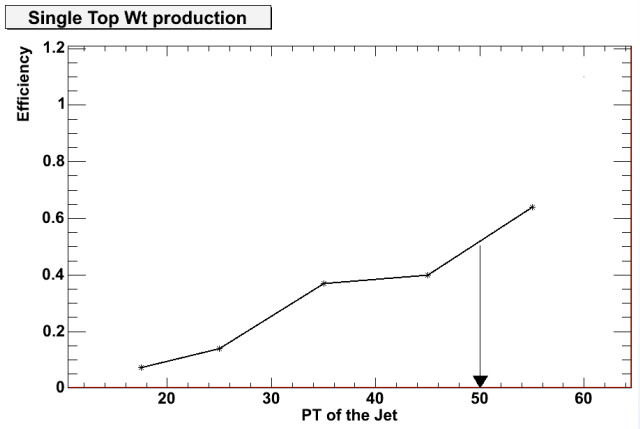




Btagging Efficiency – Rome







After Rome

- Suggestion to use SV1, IP2D and IP3D
- Weights accessed from AOD:
  - M_bjetwSV1[j] = (*newBJets)[j]->weightForTag("SV1");
  - m_bjetwIP2D[j] = (*newBJets)[j]->weightForTag("IP2D");
  - m_bjetwIP3D[j] = (*newBJets)[j]->weightForTag("IP3D");

- Various web pages/instructions suggest a cut at

Weight > 3.0 to select b-jets

B-tag efficiencies

Efficiencies are calculated in the following way:

Denominator: number of jets matched with the b-parton in $\Delta R < 0.7$, with $P_T > 50$ GeV, $\eta < 2.5$

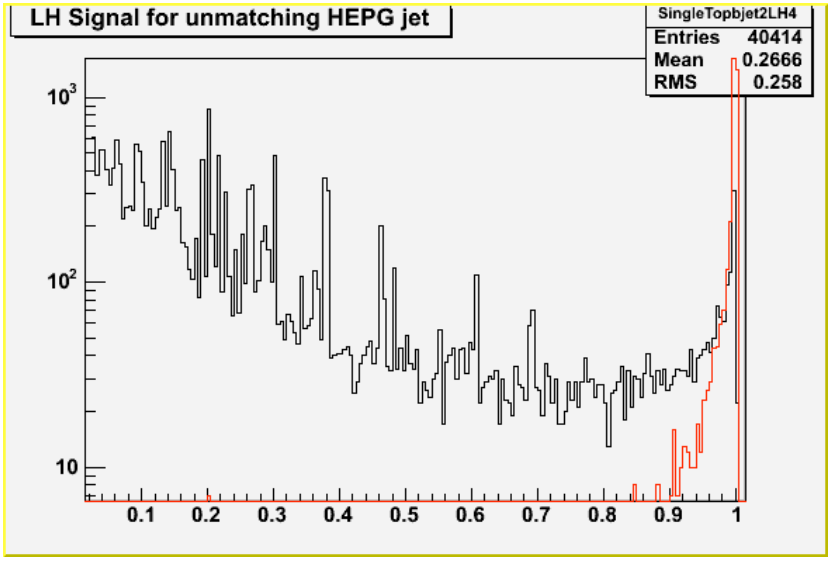
Numerator: ditto with cut on weight/likelihood

IP2D/IP3D Cut	Eff Ip2D	Eff IP3D	LHSig cut	Eff LHsig
1	0.60	0.61	0.1	0.71
2	0.54	0.56	0.2	0.75
3	0.49	0.50	0.3	0.72
4	0.43	0.45	0.4	0.69
5	0.38	0.41	0.5	0.67
6	0.33	0.37	0.6	0.66
7	0.29	0.32	0.7	0.64
8	0.25	0.26	0.8	0.63
9	0.21	0.25	0.9	0.59

B-tag efficiencies

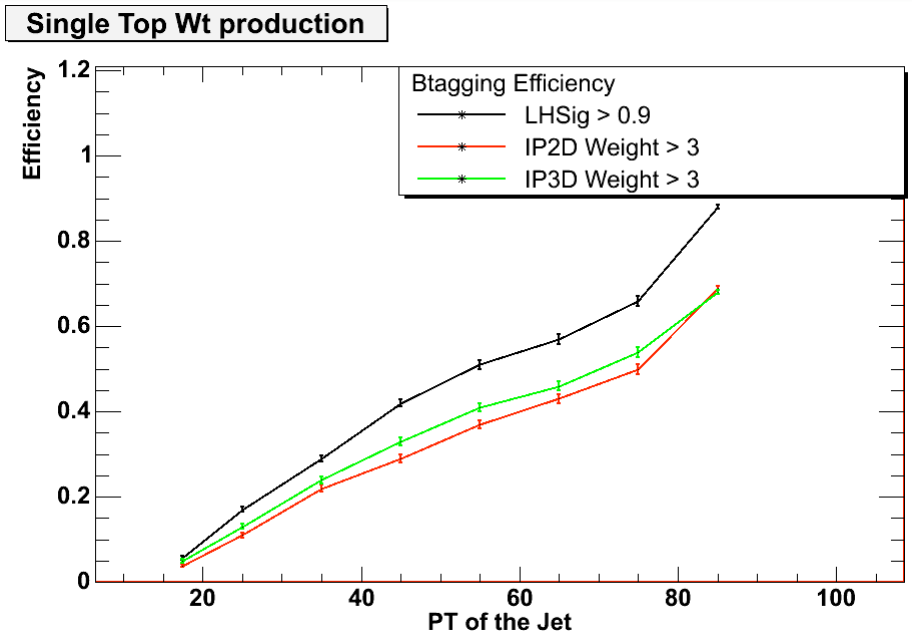
LHSig (cut at 0.9) is more efficient than the other 2 algorithms (cut at 3.0)

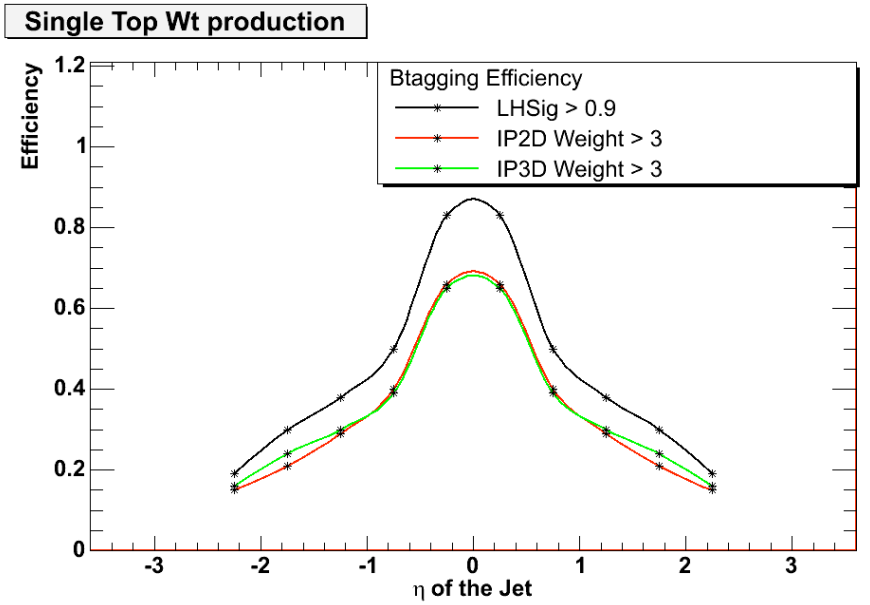
LHSig distribution:
IP2D > 3.0 (red)
IP2D < 1.0 (black)



Suggestion to re-run the tagging algs, as there were changes After Rome samples were produced.

B-tag efficiencies





Light Jet rejection

In order to reproduce the procedure outlined in Laurent's talk one should need to access the parton level information of the light jets.

This is not possible with the current AOD/ESD info
(only possible to access the b-parton information)

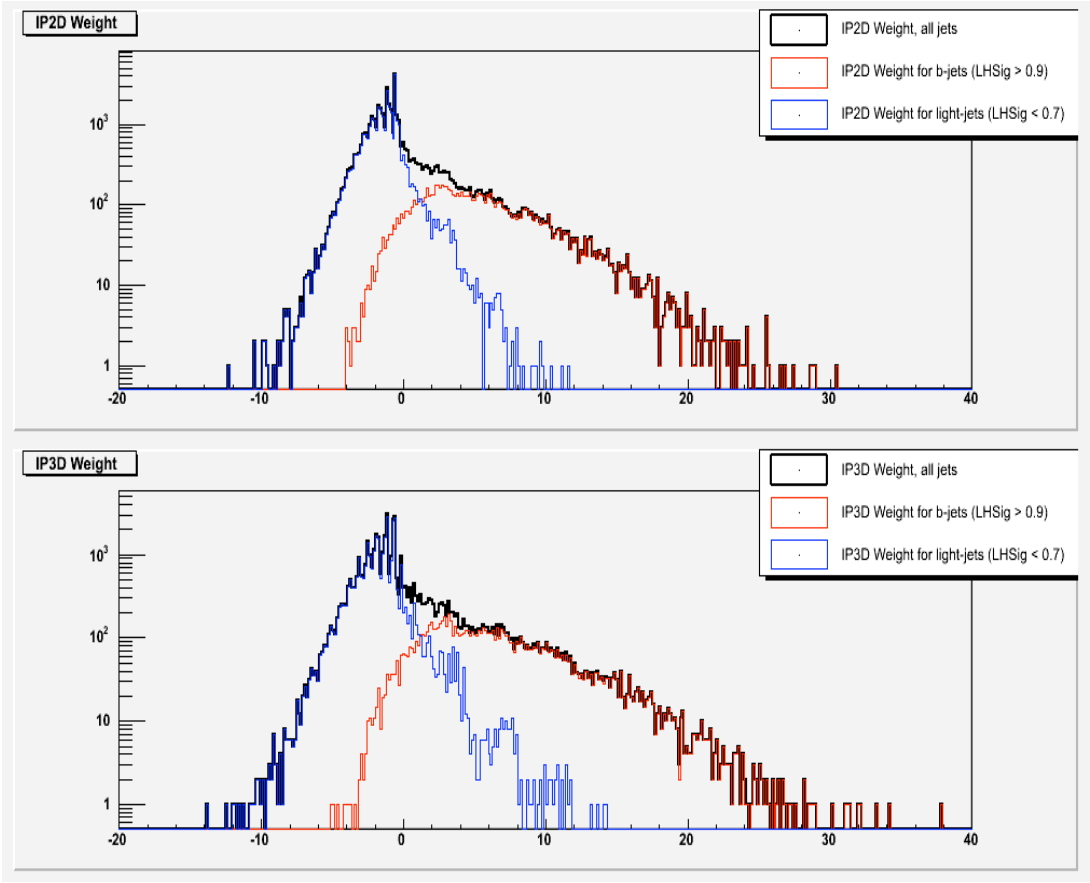
Alternative selection using LHSig for both b and light jets

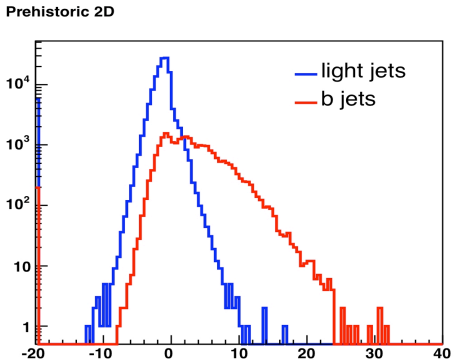
b-tagging performance estimators

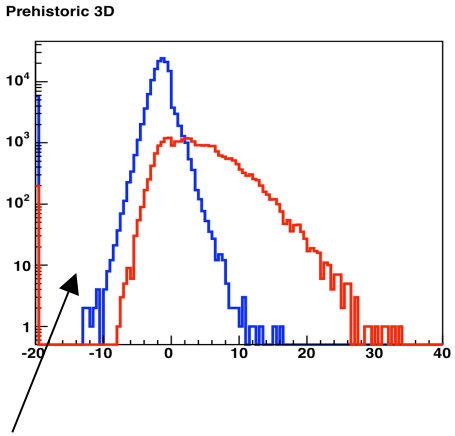
- b-jet efficiency ε_b:
  - Denominator:
    - jets defined as b using MC truth
      → jets defined using LHSig > 0.9
    - with (raw) p_T>15 GeV/c, $|\eta|$<2.5
    - NB: jets with no "good" tracks for b-tagging **are** included
    - NB: iso. electrons are not present in the JetTag collection (.)
  - Numerator:
    - ditto + cut on a tagging weight
- light-jet rejection $R_u = 1 / \varepsilon_u$
  - R=100 means 1% mistag rate
  - light jets: u, d, s, g

jets defined using LHSig < 0.7

Weights







From the Flavour Tagging Validation Twiki page

Weights

- Even using LHSig as the discriminant between light and b-jets, the weight distributions look comparable to the ones produced using MC truth matching

- Possible correlation between LHSig and the weights not considered.

Light Weight rejection

	R_u (ε_b = 50%)	R_u (ε_b = 60%)
IP2D	**125** (158 -109)	**50** (55-57)
IP3D	**200** (228-130)	**100** (86-66)
IP3D + SV1	**200** (505-325)	**142** (184-156)

WH sample (L.V.)

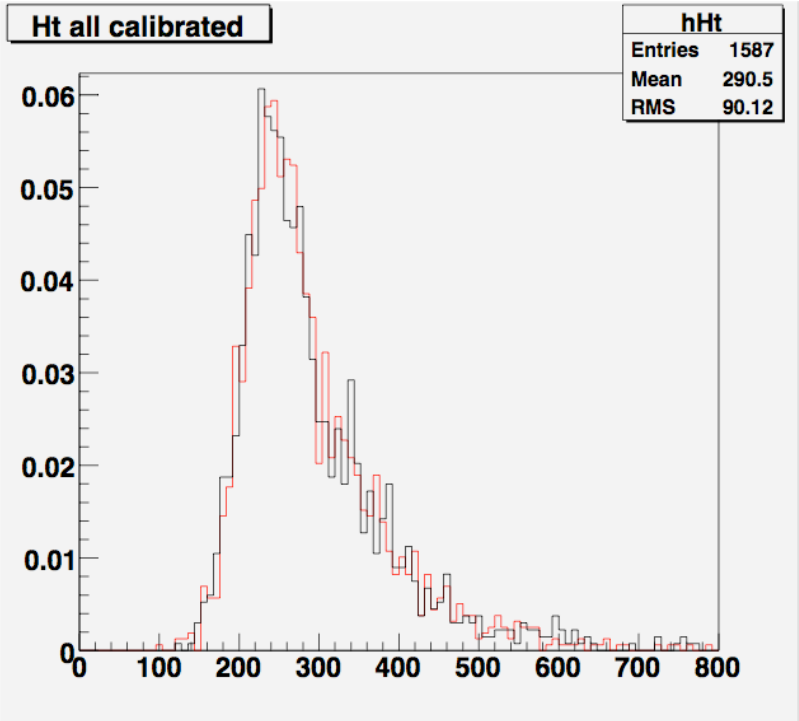
ttbar sample (L.V.)

Wt (S.R)

Jet Resolution

Jet Resolution Studies (atlfast)

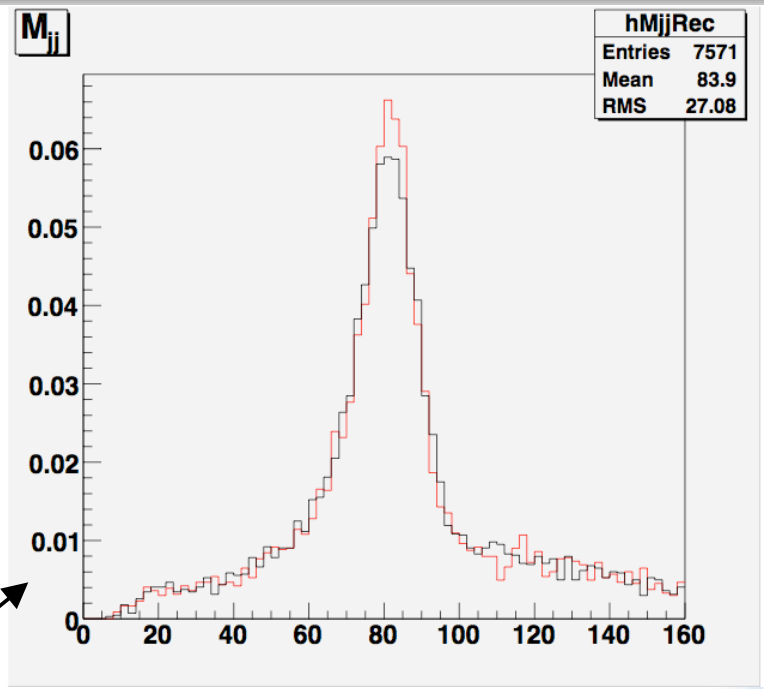
H_T distribution obtained when switching on and off the energy smearing due to the calorimeter resolution (*DoSmearing* flag)



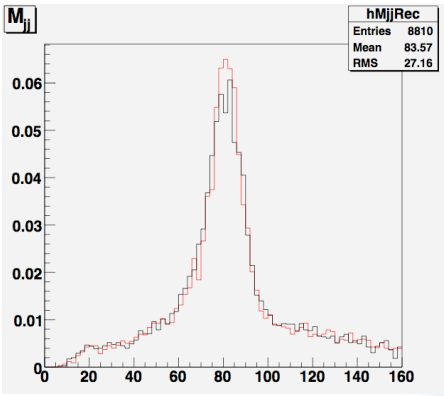
Ht distribution with standard selection cuts with (black) and without smearing (red) for 0.7 cone size on full available statistics of Wt events.

Jet Resolution Studies (atlfast)

The width of the distribution
seems dominated by the smearing due the jet reconstruction algorithm as it also seems from looking at the effect of the smearing on of on the jet jet invariant mass.



Here are the plots for the jet jet reconstructed mass for 0.7 and 0.4 cone size.



Conclusions

- B-Tag studies on Wt samples:
  - Preliminary tests on various b-tag algorithms, as out of the box on Rome samples for single top were performed
  - Generally good agreement with previous studies (L.V.)
  - LHSig seems the most powerful flag to use to select b-jets (LHSig > 0.9) in Wt data
  - More studies will be done

- Calorimeter Smearing Studies:
  - No visible effects, major effect coming from jet algorithms